

ABSTRACT OF THE DISCLOSURE

An improved selective hydrogenation process for removing acetylenic impurities such as vinyl acetylene, ethyl acetylene, propyl acetylene and acetylene in a steam cracked crude butadiene stream by selective hydrogenation is carried out in two steps. In the first step, the partial selective hydrogenation is carried out in a fixed bed with a copper based catalyst to have the ratio of vinyl acetylene to ethyl acetylene in a range of from 0 to about 1, preferably from about 0.01 to 0.6, in the product stream. In the second step, the selective hydrogenation of the remaining C₄ acetylenic impurities is carried out to completion in the catalytic distillation mode using a palladium promoted copper catalyst, an improved palladium catalyst or a combination of these two. The product stream from the first step partial hydrogenation is introduced to the catalytic distillation column at a position within the catalytic reaction zone and hydrogen feed gas is introduced below the catalyst bed to maximize the recovery of 1,3-butadiene. The feed position to the catalytic distillation column may vary along the catalyst loading zone depending on the feed composition from the first step selective hydrogenation reactor. Optionally, to prolong the catalyst service and cycle time, a solvent is added to the reactor with the hydrocarbon bed stream in the first step or the second step or both steps.